BUDGET AND ENVIRONMENTAL IMPACT ANALYSIS OF MULTILAYER WATERTIGHT CLOSURE VERSUS CONVENTIONAL CLOSURE IN TOTAL JOINT ARTHROPLASTY IN THE UK

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INTRODUCTION

Wound closure methods may influence the risk of surgical wound complications, including surgical site infection (SSI) and wound dehiscence, which are associated with increased morbidity, resource utilisation and healthcare costs[1-3]. Clinical and US economic studies indicated that multilayer watertight closure (MLWC) with STRATAFIX™ Knotless Tissue Control Devices and DERMABOND® PRINEO® Skin Closure System reduced delayed healing, reoperations, hospital stay, and healthcare costs[4].

OBJECTIVE

This study evaluates the financial and environmental impact of implementing MLWC versus conventional closure (CC) in the UK setting.

METHODS

A budget and environmental impact analysis was undertaken to compare MLWC solution to CC in total joint arthroplasty. A decision tree model estimated the total costs and climate impact for a cohort of 100 patients over a 90-day time horizon. Costs were estimated from the UK hospital perspective in order to calculate any additional costs incurred by the hospital between the two strategies. Climate impact was estimated using a carbon dioxide equivalent metric (CO_2e). Inputs were sourced from real-world data, NHS England tariffs and published literature. Each analysis examined the impact of devices and linked healthcare resource use on costs and CO_2e. A deterministic one-way sensitivity analysis (OWSA) was performed by varying input values through their 95% confidence intervals (CIs) or +/-10% of baseline values. A tornado diagram was generated to present the findings of the OWSA. A probabilistic sensitivity analysis assessed parameter uncertainty using 1,000 simulations, with input values sampled from their respective distributions. Mean costs and cost differences are reported with 95% credible intervals (CrIs), defined by the 2.5th and 97.5th percentiles of simulated outcomes.

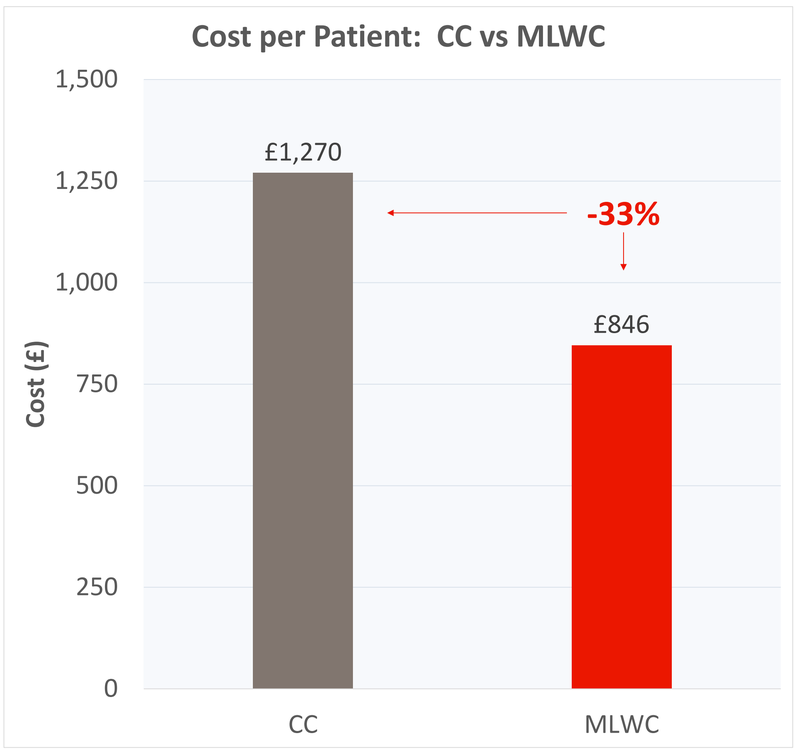
Resource model parameters	Model inputs
Reoperation (%) - CC	2.4%[4]
Reoperation reduction (%) - MLWC	97.0%[4]
Cost of reoperation	£6,457[5,6*]
Length of stay (LOS) - CC	2.41[7]
LOS cost per day	£342[6]
Reduction (%) LOS - MLWC	40%[7]
No. of outpatient visits with CC	3.0[8]
Cost per outpatient visit	£78.00[6]
Reduction (%) outpatient visits - MLWC	33.3%[8]
Dressing changes - CC	6.0[8]
Dressing changes - MLWC	0.0[8]
Cost per dressing change	£5.00[6]

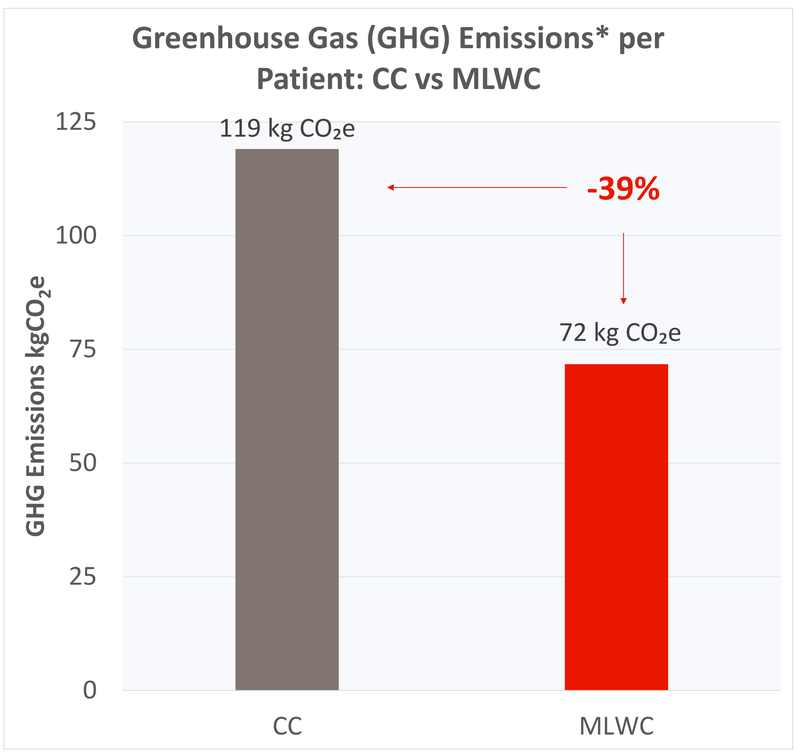
*This is based on the cost of revision surgery for the hospital as calculated by Alexiadis et al, 2024[5] (inflated to 2026) minus the cost of NHS tariff and therefore represents the cost of reoperation to the hospital

Environmental model parameters	Model inputs
GHG Emission (kgCO2eq)[9]	
Reoperation	131.70
LOS – 1 day	37.90
Outpatient visit (per visit)	1.14
Travel for Outpatient visit (round trip)	5.80

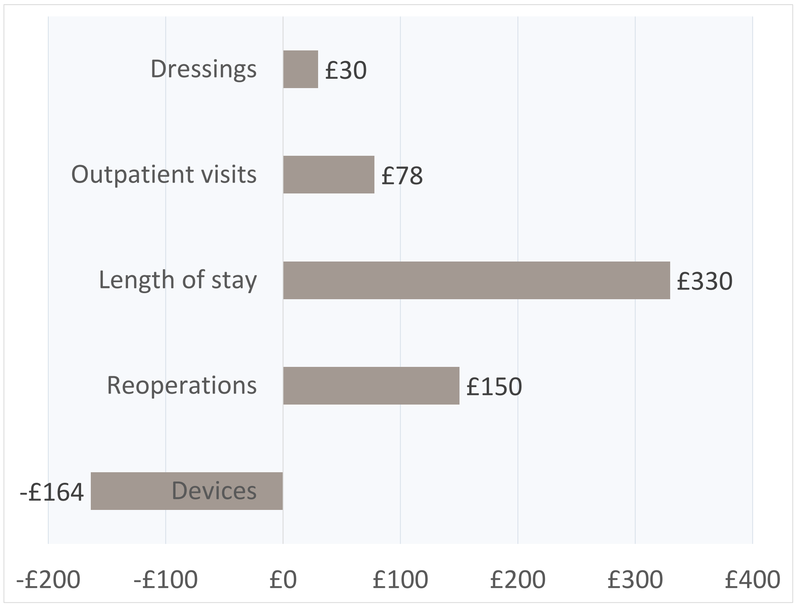
RESULTS

In the primary deterministic analysis MLWC generated a cost saving of £424.32 and reduced emissions by 47.3kg CO_2e per patient.





COST DRIVERS



A cost driver is a category contributing to the overall cost difference between treatments, with this graph showing CC minus MLWC for each category. The graph shows that MLWC's higher device cost is more than offset by modelled savings from shorter hospital stays, fewer reoperations, outpatient visits and dressings.

PROBABILISTIC ANALYSIS

Mean saving

£424

(95% CrI: £364–£490 per patient)

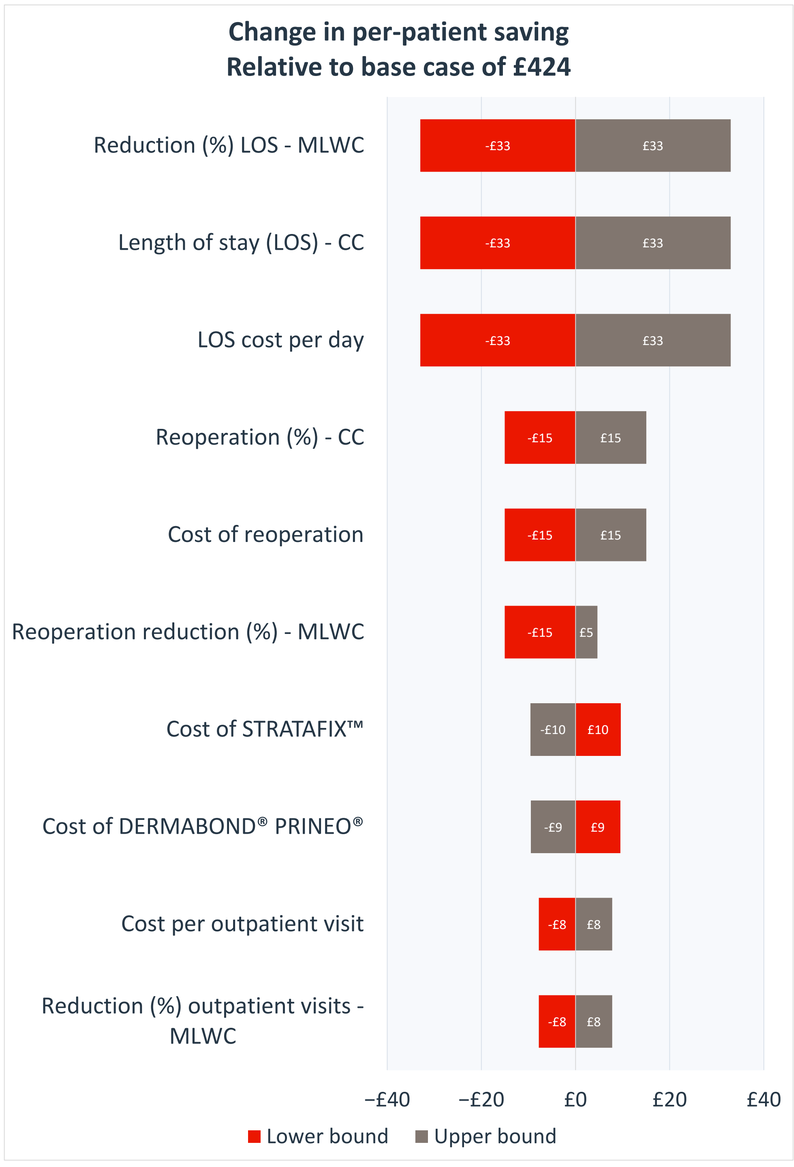
Mean emissions reduction

47 kg CO_2e

(95% CrI: 40.7–53.7 kg CO_2e per patient)

100% of 1,000 simulations estimated cost savings and lower GHG emissions with MLWC

ONE-WAY SENSITIVITY ANALYSIS



Results were most sensitive to conventional-closure length of stay, the reduction in length of stay achieved with MLWC and the cost per bed day. An increased price of STRATAFIX™ and DERMABOND® PRINEO® results in lower cost savings.

CONCLUSION

To our knowledge, along with the results in the Spanish setting, this is the first study to quantify the environmental footprint of MLWC and the first to evaluate its economic impact in a European context.
In this UK hospital model, MLWC was associated with lower costs and a smaller carbon footprint than conventional closure in total joint arthroplasty. The findings support consideration of clinical, economic and environmental value when evaluating wound-closure pathways.

REFERENCES

1. NICE NG125, Surgical Site Infection: Prevention and Treatment; 2. National Wound Care Strategy Programme. Recommendations for Preventing and Managing Surgical Wound Complications. 2024; 3. Guest JF et al. BMJ Open. 2017;7:e012540; 4. Flener JL, et al. Pragmat Obs Res. 2024;15:93–102;. 5. Alexiadis, A., et al. Revision total knee replacement finances: a detailed cost-analysis of operative practice at a regional tertiary referral centre. BMC Health Serv Res 24, 19 (2024); 6. NHS Payment Scheme 2026/27; 7. Tan Z, et al. J Comp Eff Res. 2024;13(4):e230110; 8. Sadik K, et al. Clinicoecon Outcomes Res. 2018;11:1–11; 9. Sustainable Care Pathways: Guidance on Appraising Sustainability. (2015) Sustainable Healthcare Coalition.
* GHG emissions are heat-trapping gases released by activities such as manufacturing, energy use and travel, reported as kilograms of carbon dioxide equivalent (kg CO_2e).

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